

## Section 4-6: Permutations of a Set

**By the end of this lesson, you should be able to answer:**

- How do you find the number of permutations of a set?

**Where you might see this in the real world:**

- Cooking, travel, music, sports, games

Define the following terms:

1. Permutation

2. Factorial

3.  ${}_nP_r$

Often times it is very important to worry about the order in which something happens. If you're making a cake, you're not going to cook the eggs first and then add them to the mix! You need to add them to the mix then you cook it all together!

In order to work with permutations, we are going to use the idea we learned with the fundamental counting principle. We are going to multiply the number of possibilities that we have by however many we have left.

Example 1: How many 3-digit numbers can be formed from the digits 4, 7, and 9 if no repetitions are allowed?

What we used here was the idea of a factorial. A factorial is the number of permutations of however many different items we have. We can use the formula:

Here,  $n$  is the number of different items and  $r$  is the number of items taken at a time.

Example 2: Four letters are to be taken two at a time. This is the permutation of finding as many two-letter groupings of the four letters:

Example 3: How many 3-digit numbers can be formed from the digits 4, 5, 6, 7, 8, and 9 if no repetitions are allowed?

\*\*\*Understanding Break: Complete the following problems\*\*\*

1. What is the short way of writing out  $6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1$ ?
2. Is  $2! \bullet 3!$  the same as  $6!$ ? Why or why not?
3. Which of the following is the value of  $0!$ ?  
a. 0   b. 1   c. -1   d.  $\pm 1$
4. Which of the following situations are examples of permutations?
  - a. Arranging 5 people on a bench that seats 5
  - b. Choosing 4 letters from 6 and writing all possible arrangements of the choices
  - c. Selecting a committee of 3 from 10 women

Above, you saw that  $0! = 1$ . Why is this? It all goes back to the definition of what a permutation is. Once again, a permutation deals with the order items will appear, with order being important. If we have  $0!$ , then we are looking at how many ways we can write out the number 0. So, how many ways *can* we write out the number 0? Just one. Thus,  $0! = 1$ .

More practice:

1.  ${}_{12}P_4$

2.  ${}_7P_3$

3.  ${}_9P_5$

4.  ${}_{10}P_2$

Homework:

"THE INNER FIRE IS THE MOST IMPORTANT THING MANKIND  
POSSESSES." - EDITH SODERGRAN